

AD 742621

AGARD-AG-159

AGARD-AG-159

AGARD

ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

7 RUE ANCELLE 92 NEUILLY SUR SEINE FRANCE

AGARDograph No. 159

on

Nomenclature of Terrain Colour

by

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield Va 22151

I.C.Perry

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

DDC
RECEIVED
JUN 5 1972
REGISTERED
C

NORTH ATLANTIC TREATY ORGANIZATION



DISTRIBUTION AND AVAILABILITY
ON BACK COVER

NORTH ATLANTIC TREATY ORGANIZATION
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
(ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

AGARDograph No.159
NOMENCLATURE OF TERRAIN COLOUR

by

I.C.Perry

Headquarters Army Aviation Centre
Middle Wallop, Hants, UK

COLOR ILLUSTRATIONS REPRODUCED
IN BLACK AND WHITE

This AGARDograph was prepared at the request of the
Aerospace Medical Panel of AGARD

THE MISSION OF AGARD

The mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Exchanging of scientific and technical information;
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field.
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community.

The highest authority within AGARD is the National Delegates Board consisting of officially appointed senior representatives from each Member Nation. The mission of AGARD is carried out through the Panels which are composed of experts appointed by the National Delegates, the Consultant and Exchange Program and the Aerospace Applications Studies Program. The results of AGARD work are reported to the Member Nations and the NATO Authorities through the AGARD series of publications of which this is one.

Participation in AGARD activities is by invitation only and is normally limited to citizens of the NATO nations.

The material in this publication has been reproduced directly from copy supplied by AGARD or the author.

Published March 1972

(083) 551.43:535.61



*Printed by Technical Editing and Reproduction Ltd
Harford House, 7-9 Charlotte St. London, W1P 1HD*

NOMENCLATURE OF TERRAIN COLOUR

by

I C PERRY

The words used to describe colours are often imprecise, and semantically there can be differences in the interpretation of certain colour names, even by people with normal colour vision. Thus, for example, in English, rose and pink are thought by some people to be similar, as indeed are mauve and purple, but to these difficulties must be added those of translation where there is sometimes no definite correspondence. In French, for example, the word 'pourpre' can either be translated into English as purple or as crimson.

While this lack of precision may be a nuisance in the course of day to day conversation, it takes on a serious character when applied to the operational context of, for example, a forward air controller attempting to describe a target or field colour to the pilot of a ground support aircraft. Such a problem is obviously magnified if the two individuals are of different nationalities.

It is differences such as these which indicate the need for some form of nomenclature whose aim would be to describe colours by a simple and effective system which could be understood by all, both in regard to meaning and in regard to the way in which the nomenclature would be used. Any such system which might be used by, for example, aircrew describing terrain as seen from the air has to be capable of being easily memorised without the need to refer to a colour atlas if it is to be considered as a practical means of overcoming the linguistic and semantic difficulties described in the opening paragraphs of this paper.

In any system of colour description there is obviously a variable introduced by the state of adaptation of the observer's eyes, but the intention here is not to produce an absolute scientific tool which describes a colour on the basis of its measurable physical characteristics. The intention is rather to introduce an easily understood system which can be readily applied to certain subjective appearances of colours which one would expect two normally sighted individuals to see as identical, irrespective of whether these colours are illusory, as may be the case where colour contrast produces, for example, an accentuation of greenness or of redness, or whether they are transient and affected by changes in daylight. The aim is again to produce an easily applied system which can eliminate the confusions which exist at present.

It is not practical to employ, as is often done, the name of a specific object in order to evoke a mental picture of the colour, because these mental associations obviously have limitations according to the customs in each country. For example, bricks may be either red or yellow, or even black or dark blue, so to refer to 'brick red' is rather imprecise. Similarly, in English 'pillar box red' has a certain meaning, but that meaning is lost completely if one tries to impose a similar phraseology in a country in which pillar boxes are painted yellow or blue.

Before going on to describe the system evolved, it may be useful to remind the reader of the various ways in which colour can be described. He will thus appreciate the factors which have to be taken into account and which any system of nomenclature must therefore incorporate if it is to be of practical use.

Although in the scientific nomenclature the description of a colour may refer to its saturation, the basic attributes are those of hue and of lightness. In order to describe a given colour or to maintain a colour standard, use may be made of:

1. Master samples of the item itself, such as a painted surface, piece of plastic or fabric, but these are not usually permanent for reliable use.
2. Colour atlases, ie, books and charts arranged in logical sequence and usually painted or printed. Such atlases are difficult and expensive to reproduce and are subject to fading.

and fading. These latter faults may pass unnoticed and lead to errors. The most widely used atlases are the MURRELL and OSTWALD COLOUR ATLASES and the method is suitable where high accuracy is not required and where the number of colours required is small.

3. Liquid colour standards. These are only suitable for comparison against liquid samples.

4. An infinitely variable and absolutely permanent series of colour samples. This is provided by the LOVIBOND scale of glass standards which also satisfies the criterion of expressing the three dimensions of hue, saturation and lightness in absolute terms. It is an accurate numerical system, which can convey the colour to anyone at another time or place. In day to day usage however, colour is usually described as a variation of the basic colour, and most people would be averse to a system of numbers although that system may be more accurate.

5. Finally there is the measurement of the stimulus which causes the sensation of colour. The Commission Internationale de l'Eclairage has produced a series of tables. These figures enable indirect measurements to be related to what a colour looks like by integrating (a) the energy reflected or transmitted at different wave lengths with (b) the response of the human eye, and (c) the quality of the illuminant. The final result, expressed as three figures, x, y and z, fixes the position of the colour in a defined three dimensional system. This fixes the colour quality. In addition, the reflectance or transmission is expressed as a percentage of a theoretical 100% white. Although scientifically precise, such a specification does not convey to the non-specialist a mental picture of the appearance of the sample colour being identified.

The proposed nomenclature may give the impression of being merely a small atlas as it contains a number of colour plates. However, it must be noted that it is not really the colours in these plates that are important so much as the method used to describe these and other colours. As the colour plates illustrated may alter with time and exposure, the various technical colour codes have been included in the script, so that any agency may be able to reproduce the basic colour.

Since 'Channel Capacity' limits the number of colours that can be easily remembered, the number of colours shown in the atlas, and upon which the system depends, has been kept to a minimum of eight plus black, white and grey. However, by the use of a modifier term, it is possible to describe variations in hue from one colour to another. In addition, the use of a second modifier term such as 'light', 'dark' or 'brilliant' can describe the saturation of the colour.

The system, which is simple and easy to apply after very little practice, is employed as follows.

The eight basic colours plus grey, black and white, have to be memorised in whatever language is being used. For convenience, the French and English terms are included. These are:-

| <u>ENGLISH</u> | <u>FRENCH</u> |
|----------------|---------------|
| GREY | GRIS |
| BLUE | BLEU |
| GREEN | VERT |
| YELLOW | JAUNE |
| ORANGE | ORANGE |
| RED | ROUGE |
| PINK | ROSE |
| VIOLET | VIOLET |
| BROWN | MARRON |
| BLACK | NOIR |
| WHITE | BLANC |

These colour names are used for the predominant colour which can then, if necessary, be modified by a second colour, for example:

'green - yellowish'

'vert - jaunâtre'.

Furthermore, that expression may be further modified by the following terms:

light

clair

dark

foncé

brilliant

vif

Thus, the colour of an unripe cornfield might well be referred to as

'green - yellowish - light'

'vert - jaunâtre - clair'

where 'green' is the basic term

'yellowish' is the first modifier

'light' is the second modifier.

It will be noted that, in order to identify immediately the predominant colour, this should be given first, followed by the modifier colour, if any, followed by the modifier which refers to the saturation - again only if it is required. Such an order has the advantage that the main colour is given first, but in addition this order is easily translated into French, in which the suffix '...ish' becomes '...âtre'. Some mixtures of colours are not required as they become other well-known colours. For example, 'yellowish - bluish' is the basic colour 'green', and 'red - bluish' is the basic colour 'brown'.

The following examples are merely given to show how the nomenclature is employed. They are not to be considered as ways in which the specific examples have to be described, as this will of course vary with the environment, with the lighting conditions, and with the state of the subject itself.

A ploughed field in sunlight might be:

'brown - reddish - light'

'brun - rouxâtre - clair'

A forest of pine trees might be:

'green - dark'

'vert' - foncé'

A fluorescent marker might be:

'orange - brilliant'

'orange - vif'

A brick wall might be:

'red - brownish - light'

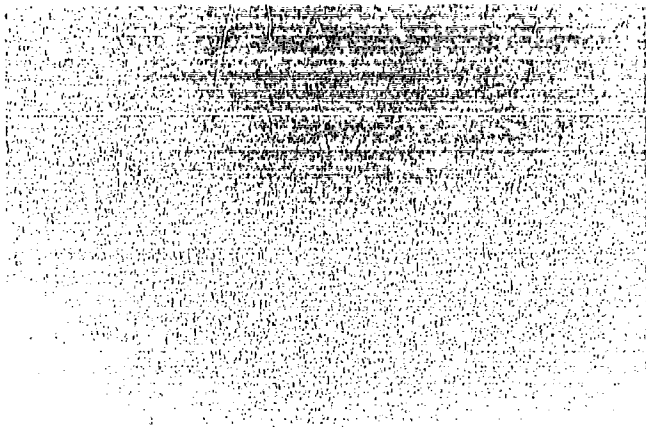
'rouge - brunâtre - clair'.

It is felt that this system of colour nomenclature, by reason of its very simplicity, may find a practical application, in particular in the Air Forces of the NATO countries, and that it may thereby help introduce greater precision in an area in which the use of day to day expressions may lead to sometimes poor accuracy.

The system used is based on the CIE - Munsell colour name system.

Acknowledgments

I am grateful to the Chairman of the Aerospace Medical Panel, Group Captain T C D Whiteside, for his help in producing this paper, and to Mr Kenneth L Kelly of the Institute of Applied Technology, National Bureau of Standards, Washington DC 20234, and Mr G J Chamberlain, Tintometer Ltd., Salisbury, England, for their advice on the more specialised aspects of colour measurement.



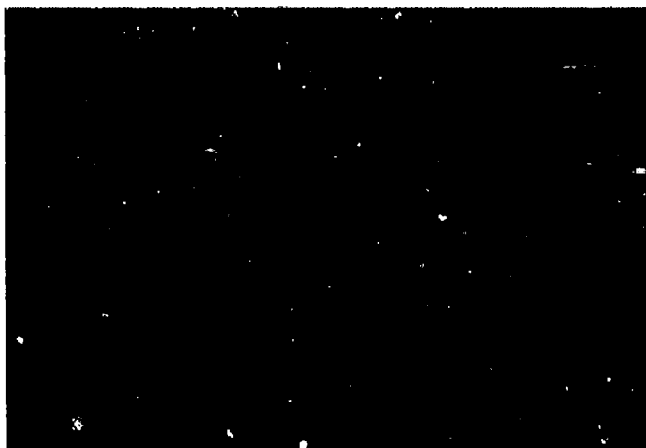
GREY / Gris

(Munsell Value N5/)



BLUE / BLEU

(Munsell Value 2.5 PB 4/10)

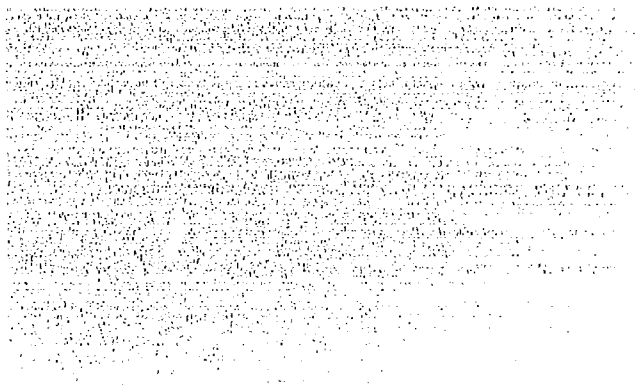


GREEN / VERT

(Munsell Value 2.5G 5/12)

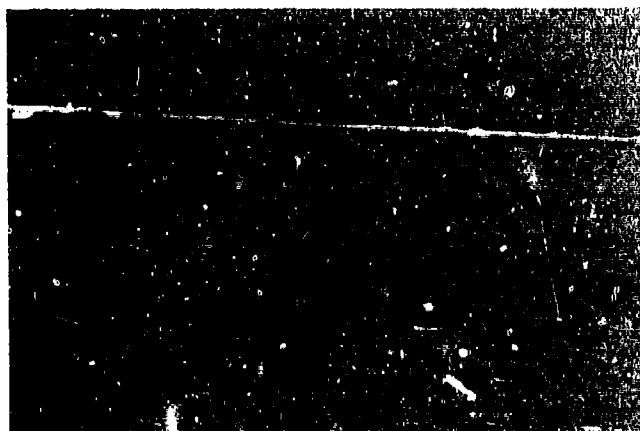
YELLOW / JAUNE

(Munsell Value 7.5 P4/10)



ORANGE / ORANGE

(Munsell Value 5 YR 7/12)



RED / ROUGE

(Munsell Value 5 Y 5/4)

PINK / ROSE

(Munsell Value 2.8R 7.2/5.3)



VIOLET / VIOLET

(Munsell Value 10 PB 4/10)



BROWN / BRUN

(Munsell Value 5.6 YR 3.5/3.9)



BROWN-REDDISH / BRUN-ROUGEÂTRE

(Munsell Value 10R 5/14)

BROWN-YELLOWISH / BRUN-JAUNÂTRE

(Munsell Value 10YR 3/6)



VIOLET-REDDISH / VIOLET-ROUGEÂTRE

(Munsell Value 5R 4.5/7)



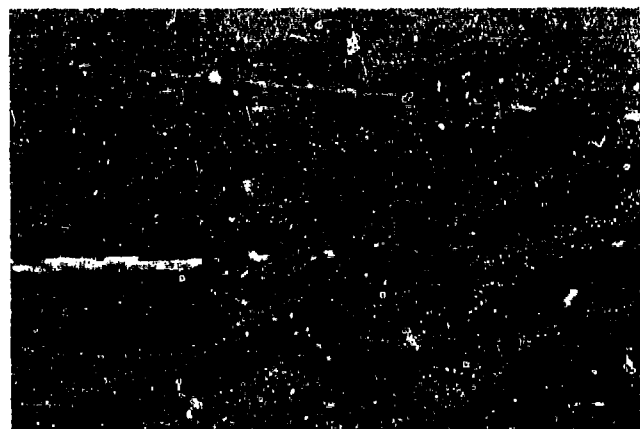
GREEN-BLUIISH / VERT-BLEUÂTRE

(Munsell Value 2.5 BG 4.5/4)



BLUE-GREENISH / BLEU-VERDÂTRE

(Munsell Value 4.7B 4.5/5.2)



YELLOW-GREENISH / JAUNE-VERDÂTRE

(Munsell Value 10Y 8/12)

| | | | |
|--|---|--|---|
| <p>AGARDograph No.159 North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development NOMENCLATURE OF TERRAIN COLOUR I.C.Perry Published March 1972 16 pages</p> <p>Descriptions of colours can give rise to differences in interpretation. A simple system has been devised for eliminating confusion in verbal or written descriptions of colours of terrain without the need of a colour atlas. The system is readily applied to the subjective appearances of colours. It is based on the ISCC-NBS colour name system and employs eight basic colours (blue, green, yellow, orange, red, pink, violet and brown) in addition to grey, black and white.</p> <p>P.T.O.</p> | <p>AGARD-AG-159 (083) 551.43:535.61</p> | <p>AGARDograph No.159 North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development NOMENCLATURE OF TERRAIN COLOUR I.C.Perry Published March 1972 16 pages</p> <p>Descriptions of colours can give rise to differences in interpretation. A simple system has been devised for eliminating confusion in verbal or written descriptions of colours of terrain without the need of a colour atlas. The system is readily applied to the subjective appearances of colours. It is based on the ISCC-NBS colour name system and employs eight basic colours (blue, green, yellow, orange, red, pink, violet and brown) in addition to grey, black and white.</p> <p>P.T.O.</p> | <p>AGARD-AG-159 (083) 551.43:535.61</p> |
| <p>AGARDograph No.159 North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development NOMENCLATURE OF TERRAIN COLOUR I.C.Perry Published March 1972 16 pages</p> <p>Descriptions of colours can give rise to differences in interpretation. A simple system has been devised for eliminating confusion in verbal or written descriptions of colours of terrain without the need of a colour atlas. The system is readily applied to the subjective appearances of colours. It is based on the ISCC-NBS colour name system and employs eight basic colours (blue, green, yellow, orange, red, pink, violet and brown) in addition to grey, black and white.</p> <p>P.T.O.</p> | <p>AGARD-AG-159 (083) 551.43:535.61</p> | <p>AGARDograph No.159 North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development NOMENCLATURE OF TERRAIN COLOUR I.C.Perry Published March 1972 16 pages</p> <p>Descriptions of colours can give rise to differences in interpretation. A simple system has been devised for eliminating confusion in verbal or written descriptions of colours of terrain without the need of a colour atlas. The system is readily applied to the subjective appearances of colours. It is based on the ISCC-NBS colour name system and employs eight basic colours (blue, green, yellow, orange, red, pink, violet and brown) in addition to grey, black and white.</p> <p>P.T.O.</p> | <p>AGARD-AG-159 (083) 551.43:535.61</p> |

| | |
|--|--|
| <p>There is provision for the addition of "modifier" terms to describe variations in hue and saturation. A colour chart with Munsell values and equivalent French and English terms for the application of the system are included.</p> <p>This AGARDograph was prepared at the request of the Aerospace Medical Panel of AGARD.</p> | <p>There is provision for the addition of "modifier" terms to describe variations in hue and saturation. A colour chart with Munsell values and equivalent French and English terms for the application of the system are included.</p> <p>This AGARDograph was prepared at the request of the Aerospace Medical Panel of AGARD.</p> |
| <p>There is provision for the addition of "modifier" terms to describe variations in hue and saturation. A colour chart with Munsell values and equivalent French and English terms for the application of the system are included.</p> <p>This AGARDograph was prepared at the request of the Aerospace Medical Panel of AGARD.</p> | <p>There is provision for the addition of "modifier" terms to describe variations in hue and saturation. A colour chart with Munsell values and equivalent French and English terms for the application of the system are included.</p> <p>This AGARDograph was prepared at the request of the Aerospace Medical Panel of AGARD.</p> |

NATIONAL DISTRIBUTION CENTRES FOR UNCLASSIFIED AGARD PUBLICATIONS

Unclassified AGARD publications are distributed to NATO Member Nations through the unclassified National Distribution Centres listed below

RECEIVED
NATIONAL TECHNICAL
MAY 18 1972
INFORMATION SERVICE

BELGIUM

Colonel R. DALLEUR
Coordinateur AGARD - V.S.L.
Etat-Major Forces Aériennes
Caserne Prince Baudouin
Place Dailly, Bruxelles 3

ITALY

Aeronautica Militare
Ufficio del Delegato Nazionale all'AGARD
3, Piazzale Adenauer
Roma/EUR

CANADA

Director of Scientific Information Services
Defence Research Board
Department of National Defence - 'A' Building
Ottawa, Ontario

LUXEMBOURG

Obtainable through BELGIUM

NETHERLANDS

Netherlands Delegation to AGARD
National Aerospace Laboratory, NLR
Attn: Mr A.H.GEUDEKER
P.O. Box 126
Delft

DENMARK

Danish Defence Research Board
Østerbrogades Kaserne
Copenhagen Ø

NORWAY

Norwegian Defense Research Establishment
Main Library, c/o Mr P.L.EKERN
P.O. Box 25
N-2007 Kjeller

FRANCE

O.N.E.R.A. (Direction)
29, Avenue de la Division Leclerc
92, Châtillon-sous-Bagneux

PORTUGAL

Direcção do Serviço de Material
da Força Aérea
Rua de Escola Politécnica 42
Lisboa
Attn: Brig. General Jose de Sousa OLIVEIRA

GERMANY

Zentralstelle für Luftfahrtokumentation
und Information
Maria-Theresia Str. 21
8 München 27
Attn: Dr Ing. H.J.RAUTENBERG

TURKEY

Turkish General Staff (ARGE)
Ankara

GREECE

Hellenic Armed Forces Command
D Branch, Athens

UNITED KINGDOM

Defence Research Information Centre
Station Square House
St. Mary Cray
Orpington, Kent BR5 3RE

ICELAND

Director of Aviation
c/o Flugrad
Reykjavik

UNITED STATES

National Aeronautics and Space Administration (NASA)
Langley Field, Virginia 23365
Attn: Report Distribution and Storage Unit

* * *

If copies of the original publication are not available at these centres, the following may be purchased from:

Microfiche or Photocopy

National Technical
Information Service (NTIS)
5285 Port Royal Road
Springfield
Virginia 22151, USA

Microfiche

ESRO/ELDO Space
Documentation Service
European Space
Research Organization
114, Avenue de Neuilly
92, Neuilly-sur-Seine, France

Microfiche

Technology Reports
Centre (DTI)
Station Square House
St. Mary Cray
Orpington, Kent BR5 3RE
England

The request for microfiche or photocopy of an AGARD document should include the AGARD serial number, title, author or editor, and publication date. Requests to NTIS should include the NASA accession report number.

Full bibliographical references and abstracts of the newly issued AGARD publications are given in the following bi-monthly abstract journals with indexes:

Scientific and Technical Aerospace Reports (STAR)
published by NASA,
Scientific and Technical Information Facility,
P.O. Box 33, College Park,
Maryland 20740, USA

United States Government Research and Development
Report Index (USGDR), published by the
Clearinghouse for Federal Scientific and Technical
Information, Springfield, Virginia 22151, USA



Printed by Technical Editing and Reproduction Ltd
Harford House, 7-9 Charlotte St, London. W1P 1HD